fit in the ear, includes sound transducers, and functions as a hearing aid that can be recharged an indefinite number of times, eliminating the need to replace its battery.

[0290] **FIG. 27M** shows a schematic of the device of **FIG. 27E** at a radio-wave-recharging station **2792**. Radio waves from radio-wave-recharging station **2792** are picked up by antenna **2750**, and the received radio wave's power is scavenged to recharge battery **2320** using a conventional recharging circuit, e.g., implemented in circuit **2440**.

[0291] Solid-state rechargeable batteries such as those described above have the unique ability of being integrated directly with the electronics they will power. Further integration of thin-wire antenna/coil **2660** or **2750** to be used as one of the coils of a two-part transformer such as shown in **FIG. 27**K and/or RF-scavenging technology such as that used in keyless entry systems allows the recharging of the solid-state thin-film battery **2320** wirelessly (through the air). Using techniques already common in RF I.D. tagging, the communicated energy is converted into a D.C. voltage and used to perform functions on board. In the case where a battery already exists on board, the D.C. voltage is used to power up recharge circuitry to wirelessly recharge the on-board battery.

[0292] Certain needs exist within industry that would benefit from the integration of energy, storage communication and electronics on a single platform. One example is control of warehouse inventories where a small "credit card" is attached to an item in the warehouse. On board the "credit card" is an antenna, supercapacitor, solid-state battery and all required electronics. When the controller needs to know something about the package, the warehouse is queried via cellular or other wireless means with the I.D. of the package in question. The query "wakes up" the package and entices it to respond with whatever data is programmed to be released. The supercapacitor discharges into the antennae-driving circuitry bursting the data out to the central computer. At the same time, the electronics on the credit-card form factor device perform a self evaluation to see if any anomalies have or are occurring such as"battery needs charging." If the answer is yes, the central computer sends a signal of appropriate length to recharge the on-board battery using technology described herein.

[0293] Another application seeing significant enhancement from the integration of energy, communication and electronics on a single platform is an implantable device such as a pacemaker. This technology allows a battery having a very large number (if not infinite) charge/discharge cycles to be implanted as part of a pacemaker. When a"battery-low condition" is encountered, the battery is remotely recharged through the body using AC magnetic fields, sound or ultrasound, radio-frequency or other energy sources.

[0294] Solid-state processes are used to integrate electronics, solid-state rechargeable battery, and antenna on a single platform such as a"credit card" form factor. This is possible by using the low-temperature processes for solid-state batteries and supercapacitors described.

[0295] The present invention provides a platform integrating electronics, solid-state rechargeable batteries, and antenna on a single platform such as a credit card or implantable device allowing remote wireless recharging of the on-board battery. **FIG. 27**A-**27**J show a fabrication sequence if some embodiments of an example of a credit-card form factor I.D. tag with remote recharge capability.

[0296] **FIG. 31B** shows a fabrication sequence for an example of an implantable device such as a pacemaker **3101**. This method starts with a substantially flat sheet deposited with batteries, which is then cut apart and formed into a three-dimensional shape. The method is otherwise similar to that of **FIG. 31C**.

[0297] **FIG. 31C** shows one method for making a pacemaker **3102**. The method includes a plurality of steps carrying the reference numbers **3194**, **3195**, **3196** and **3197**. The pacemaker **3102** includes a first half and a second half **3130**. In the initial step, **3194**, the second half **3130** is provided. A battery cell **1110** is formed on an interior surface of the pacemaker **3102**, as shown by step **3195**. The single cell **1110** is deposited on the interior surface, as shown by step **3195**. as shown in step **3191**. The electronics **3150** are then placed onto the battery **1110** to form a circuit with the battery **1110**, as depicted by step **3196**. The first half **3131** of the enclosure is placed over the second half **3130** to form the assembled pacemaker **3102**, as depicted by step **3197**.

[0298] Solid-state rechargeable batteries such as those described above have the unique ability of being integrated directly with the electronics they will power. Further integration of thin-wire antenna and an energy burst device such as a supercapacitor would allow the device to communicate over large distances via any possible number of current communication methods including but not limited to cellular.

[0299] This invention relates to solid-state rechargeable batteries and the integration of such with wireless communication (antennae and electronics), supercapacitor and conventional electronics on a single platform.

[0300] Certain needs exist within industry that would benefit from the integration of energy, communication and electronics on a single platform. One example is control of warehouse inventories where a small"credit card" is attached to an item in the warehouse. On board the"credit care" are an antenna, supercapacitor, solid-state battery and all required electronics. This"credit card" allows tracking of location, time at location, description of item in question and/or information on the environment. When the controller needs to know something about the package, the warehouse is queried via cellular or other wireless means with the I.D. of the package in question. The query "wares up" the package and entices it to respond with whatever data is programmed to be released. The supercapacitor discharges into the circuitry driving the antennae bursting the data out to the central computer. At the same time, the electronics on the "credit card" performs a self evaluation to see if any anomalies have or are occurring such as battery needs charging. If the answer is yes, the central computer could send a signal of appropriate length to allow recharge of on-board battery using technology described above.

[0301] Solid-state processes are used to integrate electronics, solid-state rechargeable battery, supercapacitor and antenna on a single platform such as a "credit card" form factor. This is possible by using the low-temperature processes for solid-state batteries and supercapacitors described above.